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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/534,087	01/20/2006	Yuning Li	11439-1	2438
25277 7590 10/30/2008 NATIONAL RESEARCH COUNCIL OF CANADA 1200 MONTREAL ROAD BLDG M-58, ROOM EG12 OTTAWA, ONTARIO, K1A 0R6 CANADA				
EXAMINER WILSON, MICHAEL H				
ART UNIT		PAPER NUMBER		
1794				
MAIL DATE		DELIVERY MODE		
10/30/2008		PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/534,087

Applicant(s)

LI ET AL.

Examiner

MICHAEL WILSON

Art Unit

1794

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 May 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 May 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/5508)
- 4) ☐ Interview Summary (PTO-413)
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____
- Paper No(s)/Mail Date _____

DETAILED ACTION

Drawings

1. In addition to Replacement Sheets containing the corrected drawing figure(s), applicant is required to submit a marked-up copy of each Replacement Sheet including annotations indicating the changes made to the previous version. The marked-up copy must be clearly labeled as "Annotated Sheets" and must be presented in the amendment or remarks section that explains the change(s) to the drawings. See 37 CFR 1.121(d)(1). Failure to timely submit the proposed drawing and marked-up copy will result in the abandonment of the application.

Specification

2. The substitute specification filed 6 May, 2005 has not been entered because it does not conform to 37 CFR 1.125(b) and (c) because: A marked-up copy of the substitute specification has not been supplied (in addition the clean copy).
3. The disclosure is objected to because of the following informalities:
- a. The citations 4-6 in paragraphs [016] and [017] are confusing. Paragraph [016] refers to the condensation reaction of boronic acid and paragraph [017] refers to the forming of cross-linked networks. However references 4-6 discuss fluorene polymers formed by Suzuki coupling and do not appear to include a condensation reaction as discussed in paragraph [016].

- b. Schemes 2 and 3, on pages 18 and 19 of the specification, appear to be the same scheme.

Appropriate correction is required.

Claim Objections

4. The numbering of claims is not in accordance with 37 CFR 1.126 which requires the original numbering of the claims to be preserved throughout the prosecution. When claims are canceled, the remaining claims must not be renumbered. When new claims are presented, they must be numbered consecutively beginning with the number next following the highest numbered claims previously presented (whether entered or not).

Misnumbered claims 18-25 have been renumbered 17-24.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1-24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 1, 4, 7, 11, and 16, the phrase "such as" renders the claim indefinite because it is unclear whether the limitations following the phrase are part of

the claimed invention. See MPEP § 2173.05(d). Claims 2, 3, 5, 6, 8-10, 12-15, 17-20, 22, and 23 are indefinite by dependence.

Regarding claims 2, 5, 8, 12, and 21, the claims are unclear because they refer to a figure or essential elements of the claim. Claims should not refer to figures.

Further regarding claim 21, the claim is indefinite because it is unclear what is encompassed by the term "etc."

Regarding claims 10 and 19, the terms CzBA and FnBA are not standard abbreviations found in the art and therefore are indefinite unless defined in the claim.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims 1-9, 11-18, and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Woo et al. (6,309,763 B1) in view of Snyder et al. (Aryl boronic acids. II. Aryl boronic anhydrides and their amine complexes.) and Anderson et al. (US 2003/0072943 A1).

Regarding claims 1-9, 11-13, 21 and 24, Woo et al. disclose a multilayered composite material comprising fluorene and arylamine copolymers (column 1, line 31 to column 2, line 10). The copolymer is disclosed to be suitable as a light-emitting material and/or a hole transporting material and suitable for light-emitting and hole transporting layers (column 2, lines 45-47). Fluorene is well known to inherently have a light-emitting functionality and arylamines are known to have an inherent hole transporting functionality. Additionally the reference discloses boronates or boronic acid groups on the fluorene monomers (column 9, lines 45-67), which meet structure I of claim 21, and a method of attaching boronic acid groups to the fluorene (column 10, lines 14-24). The reference further discloses a two layer composite wherein a hole-transporting layer is formed on a substrate and formed on the hole transport layer is the light-emitting layer (column 14, lines 27-30 and column 14 line 65 to column 15, line 4), which also inherently fills the function of an electron transport layer. However the reference uses Suzuki coupling to form the polymer which removes the boron containing groups.

Anderson et al. teach an improved multilayer composite (abstract). The reference teaches a multilayer composite of polymers with at least one boronic acid to promote adhesion [0022]. Use of the boronic acid promotes adhesion to subsequent layers as well as the substrate [0020].

Snyder et al. teach a reaction of boronic acids to the boronic anhydride (abstract). The reference teaches the reaction occurs at mild temperatures (gentle warming) and is a general phenomenon to boronic acids (page 3612, first paragraph under table I, lines 1-4). The reaction is taught to go to completing if water is removed from the solvent (page 3612, first paragraph under table I, lines 11-14).

It would be obvious to one of ordinary skill in the art at the time of the invention to try coupling the fluorene and arylamine monomers of Woo et al. by using the condensation reaction of Snyder et al., which would intrinsically resulting in crosslinking. One of ordinary skill in the art would be motivated by a desire to incorporate boronate into the polymer in order to improve layer adhesion. One of ordinary skill in the art would reasonably expect success given that Snyder et al. teach the reaction to be general to boronic acids and Woo et al. teach fluorene monomers bearing boronic acid groups.

Additionally regarding the arylamine monomers, it would be obvious to one of ordinary skill in the art at the time of the invention to incorporate them into the polymer of modified Woo et al. using well known established methods. One of ordinary skill in the art would readily recognize appropriate functional groups which bound to the arylamine, such as hydroxide, would react with boronic acid in a condensation reaction, meeting structure III of claim 21. One of ordinary skill in the art would be motivated by a desire to incorporate groups with different functionality into the polymer.

Regarding claims 14, 15, 22, and 23, modified Woo et al. disclose all the claim limitations as set forth above. Additionally the reference discloses applying the layers

by spin coating in DMF then drying in vacuum at 60-90°C (column 14, line 65 to column 15 line 3). While the reference does not explicitly disclose the layers as cross-linked during the drying it would be obvious to one of ordinary skill in the art at the time of the invention to do so. One of ordinary skill would readily recognize the conditions of drying to be suitable for the condensation reaction of Snyder et al., which would intrinsically resulting crosslinking, given that Snyder teaches gentle warming and removal of the water (Snyder et al. page 3912 first paragraph under table I), both of which would be accomplished by drying in vacuum at 60-90°C as taught by Woo et al. One of ordinary skill in the art would be motivated by a desire to form both the polymer and composition layer in a single step.

Regarding claims 16-18, Woo et al. disclose a multilayer photoelectric device (column 2, lines 45-47) comprising a transparent substrate (column 11, lines 60-63), a transparent electrode (column 11, lines 60-63), a hole transporting layer and a light-emitting layer (column 14, line 65 to column 15, line 5), and a second electrode (column 13, lines 21-27). The reference also discloses a composite material comprising fluorene and arylamine copolymers (column 1, line 31 to column 2, line 10). The copolymer is disclosed to be suitable as a light-emitting material and/or a hole transporting material and suitable for light-emitting and hole transporting layers (column 2, lines 45-47). Fluorene is well known to inherently have a light-emitting functionality and arylamines are known to have an inherent hole transporting functionality. Additionally the reference discloses boronates or boronic acid groups on the fluorene monomers (column 9, lines 45-67) and a method of attaching boronic acid groups to the fluorene (column 10, lines

14-24). The reference further discloses a two layer composite wherein a hole-transporting is formed on a substrate and formed on the hole transport layer is the light-emitting layer (column 14, lines 27-30 and column 14 line 65 to column 15, line 4), which also inherently fills the function of an electron transport layer. However the reference uses Suzuki coupling to form the polymer which removes the boron containing groups.

Anderson et al. teach an improved multilayer composite (abstract). The reference teaches a multilayer composite of polymers with at least one boronic acid to promote adhesion [0022]. Use of the boronic acid promotes adhesion to subsequent layers as well as the substrate [0020].

Snyder et al. teach a reaction of boronic acids to the boronic anhydride (abstract). The reference teaches the reaction occurs at mild temperature (gentle warming) and is a general phenomenon to boronic acids (page 3612, first paragraph under table I, lines 1-4). The reaction is taught to go to completing if water is removed from the solvent (page 3612, first paragraph under table I, lines 11-14).

It would be obvious to one of ordinary skill in the art at the time of the invention to try coupling the fluorene and arylamine monomers of Woo et al. by using the condensation reaction of Snyder et al., which would intrinsically resulting crosslinking. One of ordinary skill in the art would be motivated by a desire to incorporate boronate into the polymer in order to improve layer adhesion. One of ordinary skill in the art would reasonably expect success given that Snyder et al. teach the reaction to be

general to boronic acids and Woo et al. teach fluorene monomers bearing boronic acid groups.

Additionally regarding the arylamine monomers, it would be obvious to one of ordinary skill in the art at the time of the invention to incorporate them into the polymer of modified Woo et al. using well known established methods. One of ordinary skill in the art would readily recognize appropriate functional groups which bound to the arylamine, such as hydroxide, would react with boronic acid in a condensation reaction. One of ordinary skill in the art would be motivated by a desire to incorporate groups with different functionality into the polymer.

10. Claims 10 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Woo et al. (6,309,763 B1) in view of Snyder et al. (Aryl boronic acids. II. Aryl boronic anhydrides and their amine complexes.) and Anderson et al. (US 2003/0072943 A1) as applied to claims 9 and 18 above, and further in view of Yu et al. (US 5,055,366).

Regarding claims 10 and 19, modified Woo et al. disclose all the claim limitations as set forth above. However the reference does not disclose incorporating carbazole into the polymer.

Yu et al. teach is a related field of endeavor that carbazoles, which are a type of arylamine, are inherently hole transporting groups and may be used in polymers (column 12, lines 22-23). The reference also discloses carbazole with a pentane chain attached to the nitrogen atom. While pentane is a smaller alkyl chain than octane, it

would be obvious to one of ordinary skill at the time of the invention carbazoles with various sizes of alkyl groups would all possess similar hole transporting properties given that alkyl homologs (compounds differing regularly by the successive addition of the same chemical groups) are closely related structures. The courts have held as found in *In re Wilder*, 563 F.2d 457, 195 USPQ 426 (CCPA 1977), that compounds which are homologs "are generally of sufficiently close structural similarity that there is a presumed expectation that such compounds possess similar properties".

It would be obvious to one of ordinary skill in the art at the time of the invention to add carbazole to the polymer of modified Woo et al. and use the resulting polymer in a hole transporting layer. One of ordinary skill would reasonably expect such an addition to be suitable given that Yu et al. teach carbazoles to be hole transporting groups, and that the polymer of modified Woo et al. is taught to be suitable for hole transporting. Additionally, given that carbazole is the N derivative of fluorene, it would be obvious to one of ordinary skill in the art at the time of the invention to incorporate the carbazole into the polymer using the same method as used for fluorene utilizing known synthetic methods. One of ordinary skill would be motivated by a desire to incorporate different groups into the polymer of modified Woo et al. in order to turn the hole transporting properties of the polymer.

11. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Woo et al. (6,309,763 B1) in view of Snyder et al. (Aryl boronic acids. II. Aryl boronic anhydrides and their amine complexes.) and Anderson et al. (US 2003/0072943 A1) as applied to

claims 9 and 18 above, and further in view of Yu et al. (US 5,055,366) as applied to claim 19 above, and further in view of Zheng et al. (US 6,268,072 B1).

Regarding claim 20, modified Woo et al. disclose all the claim limitations as set forth above. Additionally the reference discloses using metallic cathode (column 13, line 21). The cathode is disclosed to preferably contain magnesium (Mg) (column 13, line 27). The reference also discloses silver (Ag) and aluminum as suitable cathode materials (column 13, lines 44-47). However the reference does not explicitly disclose a Mg:Ag cathode.

Zheng et al. teach a similar polymer electroluminescent device (abstract). The reference teaches magnesium alloys as a preferred cathode (column 40, lines 7-10), and specifically teaches a Mg:Ag cathode (column 52, lines 27-30).

It would be obvious to one of ordinary skill in the art at the time of the invention to use a Mg:Ag cathode in the device of modified Woo et al. One of ordinary skill would reasonably expect a Mg:Ag cathode to be suitable given that Zheng et al. teach it to be suitable for polymer electroluminescent devices. Additionally both references recognize the equivalence and interchangeability of different cathodes by teaching cathodes of various materials are suitable (Woo et al. column 13 lines 21-27 and 44-48; Zheng et al. column 40, lines 7-10).

In view of Woo et al. and Zheng et al.'s recognition that various cathodes are equivalent and interchangeable, it would have been obvious to one of ordinary skill in the art to substitute the calcium cathode (column 14, lines 30-31) of Woo et al. with the Mg:Ag cathode of Zheng et al. and thereby arrive at the present invention. Case law

holds that the mere substitution of an equivalent (something equal in value or meaning, as taught by analogous prior art) is not an act of invention; where equivalency is known to the prior art, the substitution of one equivalent for another is not patentable. See *In re Ruff* 118 USPQ 343 (CCPA 1958).

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL WILSON whose telephone number is (571) 270-3882. The examiner can normally be reached on Monday-Thursday, 7:30-5:00PM EST, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Callie Shosho can be reached on (571) 272-1123. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1794

13. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MHW

/Callie E. Shosho/
Supervisory Patent Examiner, Art Unit 1794